

# Supplemental Material: Toward precise simulations of the coupled ultrafast dynamics of electrons and atomic vibrations in materials

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## I. ELECTRON-PHONON SCATTERING RATES

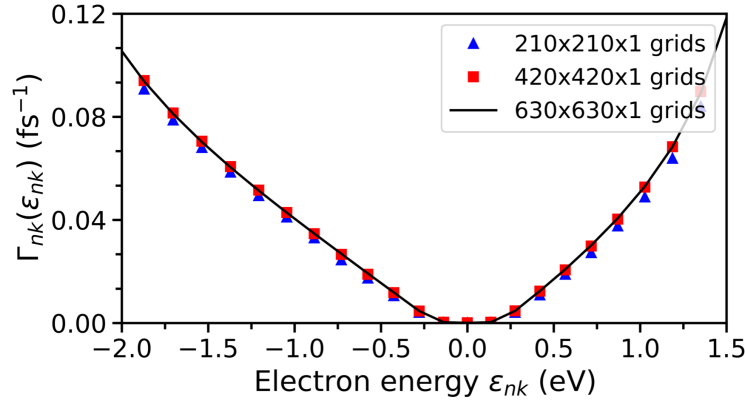


FIG. 1. Electron-phonon scattering rates in undoped graphene at 300 K, shown for various Brillouin zone  $\mathbf{q}$ -point grids. Convergence is achieved for the 420x420x1  $\mathbf{q}$ -grid used in the ultrafast dynamics simulations.

## II. PHONON-PHONON SCATTERING RATES

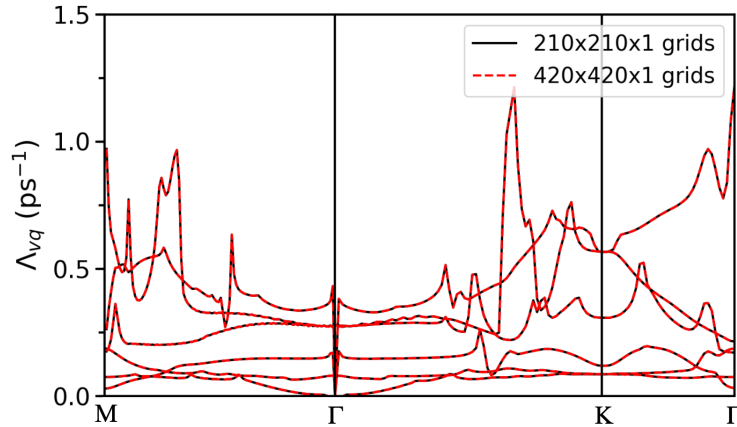


FIG. 2. Phonon-phonon scattering rates at 300 K in graphene, shown along high-symmetry Brillouin zone lines for all phonon branches. Calculations are shown for 210 x 210 x 1 and 420 x 420 x 1  $\mathbf{q}$ -point grids. The results obtained for the 210 x 210 x 1 grid are fully converged. The ultrafast dynamics employed a finer, 420 x 420 x 1  $\mathbf{q}$ -point grid, to match the grid needed for e-ph processes.

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